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THE WORKS OF EDWARD JENNER.

BY
GEORGE DOCK, A. M., M. D.,
ANN ARBOR, MICH.

Reprinted from the
New York Medical Journal
for November 29 and December 6, 1902.

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For November 29 and December 6, 1902.

THE WORKS OF EDWARD JENNER AND THEIR VALUE IN THE MODERN STUDY OF SMALLPOX.*

By GEORGE DOCK, A. M., M. D.,
ANN ARBOR, MICH.,
PROFESSOR OF MEDICINE IN THE UNIVERSITY OF MICHIGAN.

Jenner's *Inquiry*: "No book so small has been talked of so much; no book has been read from the original so little; no book of such dimensions has made the name of any author so famous."—Sir Benjamin Ward Richardson.

Few topics in medicine are more interesting than the history of vaccination, and the extract I have taken as a text may serve to show the particular aspect of the subject I wish to discuss. Through the kindness of Dr. William Osler—one of many examples of a generosity for which I can not adequately express my gratitude,—I was able recently to examine a full collection of first editions of Jenner's works on vaccination. The collection itself is particularly interesting in having been given by Jenner to his friends, W. F. Shrapnell and Henry J. Shrapnell, who will be remembered by readers of Baron's *Life of Jenner*. The volumes, bound together, were

* Read before the Buffalo Academy of Medicine, October 14, 1902.

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ultimately presented by the family of Dr. Hunter McGuire to Dr. Osler, and it is hardly necessary to add that a more appreciative owner could not be found. Jenner's first three works on vaccination had long been familiar to me through a copy of the second edition, but in the McGuire-Osler collection I read for the first time the brief pamphlet on the *Origin of the Vaccine Inoculation* and the *Instructions for Vaccine Inoculation.* These emphasized certain of Jenner's characteristics, viz., his practical sagacity, coming as it does so near to inspiration, and his lack of method. The study of the later pamphlets led me to investigate Jenner's life and work after the announcement of vaccination. My examination included a large proportion of the books and pamphlets concerning vaccination published during Jenner's life, and a great deal of periodic literature of the same era, including several non-medical journals. For the opportunity of seeing most of this great and, I may add, rare material, I am particularly indebted to the officers of the Boston Medical Library. The Boston Public Library and the Boston Athenæum also gave me opportunities for research that could not easily be found elsewhere. Thanks are further due to Dr. J. H. McCollom and Dr. Samuel W. Abbott for valuable assistance.

I do not intend to go into the details of Jenner's life, interesting as that would be. At the time of his first publication on vaccine inoculation he was in his fiftieth year. Though fond of natural history all of his life, pupil and friend of John Hunter, he yet preferred the career of a country practitioner to that of a naturalist or medical teacher. An active, popular

and successful physician, he had shown more than ordinary ardor in the observation of disease and its treatment. A facile maker of verses, he shows a tendency to poetic expressions in his articles on cow-pox, as he did in his conversation and letters. As examples may be cited the answer to the question of Charles James Fox,—vaccination is "like a section of pearl on a rose-leaf,"—or when, after speaking of the effect of vaccination in healing chronic eruptions he said, "it is not one gift only that the fair and bountiful hand of Vaccina has bestowed upon us." Yet Jenner's writing is always simple and attractive. Such expressions as I have quoted seem to come rather from the exuberance of a mind naturally imaginative and poetic than from any attempt at decoration. His chief fault is in the poor arrangement and diffuseness of his material.

In his mental qualities Jenner has been compared with Franklin, and there is a resemblance in the simplicity of his observations and methods, as when he settled the question as to the hottest part of a flame by putting his finger into it. Two other facts should be mentioned before we leave the man for his work. He suffered much from illness, his wife and one son were invalids and the latter required constant care. Besides, he had a tendency to indolence, "of all the ill habits a man may fall into, the most difficult to get rid of," he said, adding: "I for one am a sad example of the truth of this position, and this very sin has got me into more scrapes than all the rest put together."

Jenner has suffered much, as his discovery has suffered, from indiscriminate praise. It is often said that he devoted his time for years,—thirty is the

period most frequently given,—to the investigation of cowpox, before he published his results. This is by no means the real basis of Jenner's claim to renown. The results are important without reference to the time spent in achieving them. Jenner himself gave twenty-two years as the period of investigation. In the parliamentary hearing which resulted in the first grant of money, ten thousand pounds, one of the witnesses stated that Jenner had spent six thousand pounds in prosecuting his inquiry, but Jenner himself never made such a claim.

The first publication, *An Inquiry into the Causes and Effects of the Variolæ Vaccinæ,* appeared in 1798, as a quarto of seventy-five pages, with four colored engravings.

The work begins, after some general observations on the variations of animals, with an explanation of the origin of cowpox in "grease," a disease of the heels of horses. Jenner thought that milkers, having previously dressed the sores of such horses, carried the disease to cows. He cited seven cases showing the relationship, as well as the immunity furnished against smallpox after accidental inoculation of grease-cowpox in man. He admitted that he had not been able to show the relations of grease and cowpox by actual experiment, but was not very critical in the matter, for he had held the belief in the grease origin of cowpox and smallpox for more than ten years. Further on in the same work he cited a case in which cowpox originated, not in matter from the heels of a horse, but in an "erysipelatous" inflammation on the upper part of the thigh of a colt. After several weeks the process terminated in the formation of

small abscesses. The same men who dressed these abscesses milked cows, and in a short time the whole dairy, twenty-four cows, had cowpox. The milkers in turn got vaccinia in varying degrees of severity according to their previous histories, one, who had never had either cowpox or smallpox, being severely affected. Circumstances prevented a test of the cowpox by variolous inoculation, yet Jenner thought there could be scarcely any room for suspicion that the disease was not true cowpox. He supposed, also, that the specific virus became more "certain and determined in the cow," because it was easier for milkers to become infected than for the dressers of sore heels, but, aside from the experiments he thought of but did not make, he seems not to have considered the greater exposure in milking as compared with the dressing of horse's heels. A great deal of work was done on grease in the early years of vaccination. Many investigators agreed with Jenner; certain strains of "vaccine" virus originated in the sore heels of horses, but the final conclusion was that grease was not a specific disease, or at least not related at all to vaccinia, and if, in some cases, cowpox seemed to have originated in horses, the latter animals must have had variola. Jenner never seems to have publicly abandoned his theory, but the course of events relegated it to obscurity. While still working on his early grease observations, Jenner inoculated his son with swine pox, but he did not follow up this line of investigation.

No one seems to have tried to deprive Jenner of credit for the grease theory, but the case is very different in the next step of his work, regarding cowpox

more particularly. Just what Jenner claimed, and what he deserved in this connection, are often not remembered. As he often pointed out, the protective action of cowpox against smallpox was widely known among dairy farmers, but perhaps became recognized only after the general use of variolous inoculations, which called attention to cases refractory to the latter. Investigations aroused by Jenner's *Inquiry* fully confirmed the extent of the belief among farmers, and before that, as early as 1795, Adams, in his *Observations on Morbid Poisons* spoke of it as a well-known fact. The question whether the accidental infection might not be used with a distinct purpose must also have been raised by many. Ring, one of Jenner's most ardent supporters, says he was often asked by patients whether cowpox or chickenpox would not protect against smallpox. Nor was the knowledge of cowpox confined to England. Heim tells us that his father, a preacher in Saxe Meiningen, told him as early as 1763, when one of his cows had cowpox, that the dairymaids who milked such cows became infected, and added it was believed those who once had the vaccine disease never took smallpox. But whenever such facts were mentioned contradictory experiences were not wanting. So Jenner was often reminded by his friends, and the feeling of the latter shows why the observation of immunity was not earlier acted upon. After Jenner's claims were published, and especially at the time of the parliamentary action on Jenner's petition for a grant in 1802, other cases of planned inoculation came to light. Among these were some ascribed to Nash, a surgeon in Devonshire, and a Mrs. Rendall, but the most important

were those of the now well-known Jesty. It is interesting to observe that in this case the champions of Jesty did not even know either his name or his habitation. Pearson called him Justin. His visit to London and the painting of his portrait were both done to discredit Jenner, but the outcome did the latter no harm. Many years later Husson asserted that Rabaut, a protestant minister of Montpellier, had vaccinated in 1781, having derived the idea from a farmer, and that the operation was suggested to Jenner by a Frenchman. Husson should have put the date earlier. There is no doubt that Jenner had talked of vaccination before 1781. None of these earlier observations, interesting as some of them are, weaken Jenner's claim in the slightest degree. He not only inoculated cowpox virus with the purpose of protecting against smallpox, but also with the aim of making the operation known, and he not only did make it known, but he put it beyond question that, but for him, Jesty and all the other claimants might have remained long in the obscurity in which his discovery found them. He also carried the inoculation through several generations in the human body, proving the possibility of becoming independent of primary cowpox, and in marked contrast to Jesty, he overcame the fear of the disease. Thus he caused vaccination to be practised by others, so that from a casual and formidable operation it became used all over the world on an enormous scale, and always in association with his own name. How he did this is an interesting part of the subject.

Jenner gave brief notes showing the protective action of casual cowpox against variola, acquired either

naturally or by inoculation. The interval between infection and test varied in different cases from a few months to fifty-three years, though in only three was it more than thirty years. He also cited cases showing that smallpox gave immunity sometimes, but not always, against cowpox, and others proving that cowpox could repeatedly infect the same subject. He promised to give a great number of instances showing the protective influence of cowpox. He really gave only sixteen, and not all of these in detail, but we must remember that this was before the numerical method was applied seriously to medicine. After all, the number of cases is not much smaller than that cited by one of the greatest students of ætiology and prophylaxis in an address of fundamental importance more than one hundred years after Jenner. At the present day we should expect protocols of all cases of cowpox infection and some at least from cases simulating cowpox, but such critical methods were not known in Jenner's time. He had collected more cases showing the protective action of cowpox than had ever been published before, and had drawn from them conclusions of far-reaching importance.

For he was now at the point where an experiment was necessary, an experiment quite as novel as that of Columbus when he started for the shores of Cathay. On May 14, 1796, he inoculated James Phipps, a lad of eight years, with matter taken from a sore on the hand of Sarah Nelmes, "a dairy maid who was infected from her master's cows." The matter "was inserted into the arm by means of two superficial incisions, barely penetrating the cutis, each about half an inch long." "On the seventh

day the boy complained of uneasiness in the axilla, and on the ninth he became a little chilly, lost his appetite, and had a slight headache." On the day following he was well. "The appearance of the incisions in their progress to a state of maturation were much the same as when produced by variolous matter." The only difference Jenner perceived was in the state of the limpid fluid, which assumed rather a darker hue, and in the efflorescence around the incisions, which had more of an erysipelatous look than is usual after variolous inoculation. The boy was tested with variolous matter six weeks later, but was refractory, and it may be added that he was inoculated many times in later years—twenty, Jenner said, —but never took smallpox. The success of the experiment was therefore perfect. Jenner intended to publish his results at this stage, but did not, nor did he until 1798 find opportunities for repeating his experiment. This new series began in a case of grease, which affected three servant men, two of whom had had inoculated variola. From a sore on the hand of one of the two, a boy was inoculated. Jenner's object in this was to see if the passage through the human subject would render grease matter a sure protection, as did the passage through the cow. However, the boy had a contagious fever and was rendered unfit for further inoculations. In the meantime the cows became affected from the same man, and from one of the cows the first of a series of cases was inoculated, and the virus carried through five generations. One out of four of the fourth generation failed to take. The matter lost none of its original properties in the passage, so far as the lesions

were concerned, and a subsequent inoculation test of three of the subjects showed they were immune to variola.

These experiments were ended about the middle of April, 1798; the inoculations somewhat later. The dedication of the first edition of the *Inquiry* is dated June 21, 1798, and the volume appeared soon after that date. Following the experiments and observations mentioned, which occupy a little more than half the book, Jenner gave a number of speculations and conclusions bearing on different aspects of vaccination and smallpox. He based the value of his observations on the possibility of superseding variolous inoculations, "which even under the best management sometimes produced deformity of the skin and even death." He had never known of cowpox being fatal, even when acquired under the most unfavorable circumstances. Moreover the fact that vaccinia could be acquired only by inoculation and not by "effluvia," which Jenner had tested, made it much more manageable than smallpox. He held that cowpox gave perfect immunity against smallpox, and thought it could be inoculated at anytime (though he gave a case to the contrary), while smallpox sometimes failed to take when inoculated. At this time he did not seem to think smallpox could be extirminated, as he did later. Another of his beliefs was that scrofula was not so likely to be excited by vaccination as it was by variola. One of the most interesting remarks is "It is not the identical matter inserted which is absorbed into the constitution, but that which is, by some peculiar process in the animal economy, generated by it"; but this idea he did not develop farther than to

suggest that "different parts of the body may prepare or modify the virus differently."

In conclusion he held the subject out as one worthy of further investigations, and promised for his own part to "prosecute the inquiry, encouraged by the hope of its becoming essentially beneficial to mankind."

On the whole, the *Inquiry* does not seem like a work destined to cause a therapeutic revolution. Reading it in our present light, one must be struck by the incompleteness of many parts of the evidence. We find, for example, no systematic description of vaccine lesions, day by day, either in man or cows. Those relating to cowpox, though much fuller than those of human lesions, have been well described by Bousquet as of a *"laconisme désespérant."* But we must remember that experiments in pathology, ætiology, and immunity were all but unknown at that time, and even careful descriptions of clinical phenomena, such as Jenner had to deal with, were by no means the rule. The small number of the experiments made by Jenner did not necessarily weaken his conclusions as to the main fact, but explains why he got and tenaciously held what proved to be erroneous ideas of some of the associated features of vaccination. It does not seem that Jenner anticipated the results of his publication; if he had, he would certainly have incorporated many facts and theories that he afterwards found necessary to print. He believed he had discovered a therapeutic measure of the greatest value, but realizing its weak points, he published it as a scientific matter, to be the subject of further investigation by himself and others.

The immediate reception of the work is said to have been lukewarm, and this was but natural, seeing that the book is free from the sanguine and exaggerated air often used by those who wish to overthrow established ideas. The natural objections, that the experimental proof was not sufficient for all the claims made, and that smallpox had been known to follow casual cowpox, checked the enthusiasm of many. For three months after the publication Jenner lived in London, but was not able to obtain a subject on whom to test his virus.

Some of the earliest opposition was made by the professional inoculators of variola, who saw a lucrative industry threatened. They had a champion in the powerful Dr. Ingen-housz, who, though no longer inoculating, still had a reputation in that line from the fact that he had, long before, been called to inoculate the children of Maria Theresa. He called Jenner's attention to some of the facts alluded to, in a courteous letter. Jenner received the information rather impatiently, and soon expanded his side of the correspondence into a pamphlet which he published in April, 1799, entitled *Further Observations on the Variolæ Vaccinæ or Cowpox*. Like the first work, this was dedicated to Parry. In the dedication Jenner expressed his pleasure at seeing the investigation so generally entered into. In the pamphlet, he said he had not been able to extend the inquiry much beyond the original limits, the reason, not given, being that the supply of vaccine virus was exhausted. He wished to communicate some new facts and to "point out the fallacious sources from whence a disease imitative of the true Variolæ Vaccinæ might

arise," in order to prevent inoculators from producing a spurious disease; also to reiterate the advantages of cutting short the inoculated local disease as soon as it produced a sufficient influence on the constitution. A large number of details follow, most of them reminding one of commentaries on the *Inquiry,* and notes on some of the objections and criticisms on that work. Ingen-housz's case of smallpox after cowpox Jenner very properly rejected, because the cow at the time of infection gave out an offensive stench from the udder. He suggested the following possible causes of spurious cowpox: pustules which contain no specific virus; virus originally good but decomposed by putrefaction or some other less obvious change; matter taken too late in the progress of the disease; some peculiar morbid matter from the horse. He suggested that those engaged in the investigation should suspend controversy until they could ascertain what was and what was not cowpox. As to the settling of that problem he begged the question, as before, rejecting the farmers as witnesses and then going back to their criterion, as the one the most worth following. According to this, spurious cowpox vesicles ("blisters on the nipple") "never eat into the fleshy parts like those which are commonly of a bluish cast, and which constitutes the true Cow-Pox." As to the change in cowpox matter, Jenner was on firmer ground, for he had the extensive history and experience of variolation to furnish examples. For preserving cowpox virus he recommended that the lymph be dried on glass or on a quill, and afterwards secured in a small vial. Thus prepared, he had found the lymph perfectly active at

the end of three months. He was as yet unable to say when the virus should be taken, but advised it should not be after ulceration (as was likely to happen) had occurred. He said that severe local lesions and sometimes general symptoms might follow the use of such material, and yet the constitution receive no protection—facts that even now are not remembered as often as they deserve. After another discussion of grease, Jenner passed on to the local lesion of cowpox and its treatment. He clearly realized that the violent symptoms sometimes seen after vaccination are secondary and do not indicate immunity, and, following the procedure sometimes used in variolation, he urged the application of red precipitate ointment or similar preparations. At this time he thought a single lesion sufficient to render the body immune to smallpox, while on the other hand he admitted that a large number of vaccine lesions might be fatal. The latter admission seems directed to reports of death following vaccination, some of which, useless now as evidence, were early published. Jenner also cited some cases illustrating the fact that the system might resist the action of smallpox even when vaccine inoculation was cut short before the virus had acted upon the system. His conclusions are not quite clear, for while the first patient tested in this manner may not have had smallpox (as seems probable to me) Jenner admitted that those who were inoculated from her did have variola, adding, "we may have it in our power to produce mild smallpox at will." Obviously, at the time this was written, Jenner did not anticipate the extirpation of smallpox, and in fact he went on to suggest variolation as a

test of the certainty of cowpox in practice, asserting that "no injury or inconvenience can accrue" from it, though only a few lines farther he admitted that in numberless instances inoculated smallpox was "baneful to the human frame." Recurring to the cutting short of the vaccine lesion, Jenner admitted that he did not know at what stage this should be done. He hoped "for further reasoning and experiments." Jenner then took up the consideration of smallpox, showing that "the constitution cannot be rendered totally unsusceptible of the variolous poison." As he truly said, smallpox is a "distemper not well understood" and he was equally correct in thinking his own discoveries would promote its investigation, though he could not be expected to realize how, for more than a hundred years, that distemper would continue to baffle the most accomplished investigators. Jenner also devoted some attention to the cases of eruption after vaccination, observed by Woodville and Pearson, but he did not state, as clearly as he might have done, that the patients had been accidentally variolated.

By the time this pamphlet was in circulation, vaccination was going on actively, assisted very materially by the writings and the virus of Woodville and Pearson, who, beginning as friends of Jenner, became his bitter rivals. The rapid development of vaccination, before the investigation hoped for by Jenner, depended upon certain facts always well to bear in mind, but often forgotten. One is the intense eagerness with which all alleged healing methods are accepted and put into practice without criticism. Another, even more important, is the

knowledge of what smallpox meant to Jenner and his contemporaries. This is by no means easy to recall, but some facts and figures may assist. For more than a thousand years smallpox had existed in Europe. Leprosy and bubonic plague had so far disappeared as to be almost forgotten; some other plagues of the middle ages, such as the sweating sickness, were no longer known; syphilis, common enough and still severe, was less feared than before, but smallpox kept up its original virulence and all its horrors. In the middle of the century De la Condamine estimated that every tenth death was due to smallpox, and that one-fourth of all mankind were either killed by it, or crippled or disfigured for life. "From love and small-pox," so ran the proverb, "none remain free." At the end of the eighteenth century forty thousand people died annually of smallpox out of the ten millions of the Prussian population. In 1800, it was imported into England twenty times by the Channel Fleet alone. In Russia one-seventh of all children were said to die of it. So rarely did children escape it that it was known technically and among the people of Germany as *Kinderpocken*. Language was not strong enough to convey the fear of the disease. The most temperate writers spoke of it as a "horrid pestilence"; the eruption was frequently described as a "heavy burden." Though it varied in severity from year to year, and though inoculation for a time lessened the dread, there was no reason for hoping the disease would naturally decline as some other pestilences had. Inoculation, while often an advantage to the individual, increased rather than lessened the total extent and the absolute mortality of

the disease. If small pox was feared in Europe, it was no less so in America, and especially in the young United States. Again and again it had raged among the colonists, as it had among the aborigines. In 1721, more than half the population of Boston had smallpox and eight hundred and fifty died of it, and in 1792, having appeared and disappeared many times in the interval, 8,346, almost half the population, were affected, a still larger number being protected by previous attacks. Waterhouse vividly describes how among the people of New England, "the most democratical region on the face of the earth," "the fear of smallpox led to restrictions of liberty such as no absolute monarch could have enforced." The Cambridge professor of medicine, the "Jenner of the new World," as Ring named him on the snuff-box Lowell thought mythical, explained the situation in the whole civilized world when he added: "We cannot wonder that to a people thus circumstanced the announcement of a mild, safe, and comparatively pleasant and non-contagious substitute for the smallpox was received with an ardor bordering on enthusiasm." Institutes for cowpox inoculation were organized before the end of 1799. Within another year Jenner wrote that 6,000 people had been vaccinated. By this time the method was already used in many parts of the continent. Aubert, who was sent to England to investigate the matter, reported to the French government in 1800. On December 10, 1800, Lavater wrote that over 1,000 children had been vaccinated in Geneva, where the physicians had so arranged that pastors gave printed advice at the end of baptism, offering free vaccination to the poor.

The startling events surrounding Napoleon's rise to the mastery of Europe did not interfere with the interchange of virus and writings among the vaccinators of various countries. While Napoleon himself liberated prisoners of war at the request of Jenner, Godoy, the notorious Prince of the Peace, started a vessel around the world, with children to be vaccinated *en route,* in order to spread the marvelous remedy in the New World. In 1806, it was said that 230,000 had been vaccinated in the Philippines. In 1800, Waterhouse began to vaccinate in Boston, Hosack soon afterwards in New York. Waterhouse said that vaccination was not begun in Philadelphia until a late period, "the leading physicians there pronouncing it too beastly and indelicate for polished society," but a marginal note, unsigned, in the copy of Baron's *Life of Jenner,* in the Boston Medical Library, says that "Dr. Wm. Yates, an Englishman, is said to have brought vaccine from Jenner in June, 1799, and vaccinated in Philadelphia." At all events, John Redman Coxe, of that city, published his *Observations on Vaccinia,* in 1802. By a common irony of human nature, the new means of saving life was soon spread among the red men who were still far too numerous and active for the comfort of the expanding white race. When the Royal Jennerian Society for the Extirpation of Small-pox held its first Festival, May 17, 1803, with "300 noblemen and gentlemen" present, a poem was read, containing the following lines, valuable alike as evidence of the spread of vaccination and of the poetic gifts of the bard:

"See prowling Indians, fixed at thy applause,
Trace thy vast gifts from the Eternal Cause;—

With peals of rapture rend the wondering air,
Lay bare their arms and mark thy glory there."

The same Society, the ideas and aim of which are fully expressed by its title, had already prepared a notice to be given by clergymen at the baptism of children, containing the following: "As you value the life of your infant and the safety of your neighborhood, you will immediately avail yourself of the advantages offered" (in vaccination).

The first thought in reference to this is that it would have been better had the matter been turned over to a commission or commissions, in order to have proper tests made. A little consideration, however, will show that this would probably have been futile. It would have been difficult to form competent commissions. The best students of pathology at that time were devoted to lines quite different from the experimental field opened by Jenner. They would have brought to the subject no more technical skill, no better ability to weigh evidence, and probably no interest. Waterhouse was quite right when he said that to wait until vaccination was demonstrated to give permanent protection would be imitating the Irishman's son, who was told not to go into the water until he had learned to swim. That being the case, nothing could have been better than the widespread experiment that was made.

In the history of the relation of the Prussian government to vaccination in the earliest days, we find much to admire, but in a country with less strongly developed bureaucratic instincts the same plan could hardly have been followed. Vaccination was begun very early in various parts of Germany, Pearson

having sent threads containing virus to Berlin, in 1799, by two noblewomen, one of whom also carried some material from Jenner. In the very beginning, Hufeland had opened the pages of his influential *Journal für die Arzneykunde* to articles on the subject, and warmly advocated the operation himself. The Prussian government first took official notice of the discovery in a circular of July 11, 1801. In this it was said that vaccination was not yet sufficiently understood to enable one to declare positively as to its merits; though reports were very favorable, the observation and collection of cases was still very important. In the meantime, it was thought best to lay down rules, so as to make use of observations and set bounds to the enthusiasm of vaccinators. Those permitted to vaccinate were accordingly named; they were ordered to keep journals, stating all particulars of their work, and to return these, under oath, every year to certain authorized bodies. Physicians were not to importune fathers, guardians, etc., to subject children to vaccination, still less to bid for patients, "partly because they were not yet able to predict the consequences of the operation, partly because physicians should be careful in experiments the effects of which they cannot state with certainty." Directions were also given regarding the proper sources, characters, preservation and use of vaccine virus. About a year after this cautious beginning, a proclamation was issued in which it was stated that 7,445 vaccinations had been reported, most of which had been tested by variolous matter, and among these were only four cases in which protection had not been definitely demonstrated. Vaccination was then per-

mitted, under certain restrictions. An interesting light is thrown on the exploitation of the operation in this document—for I cannot imagine it to be a joke—in the statement that "it can not be proved that stupid children are made clever by vaccination." A circular of the same date made it the duty of physicians to recommend vaccination to parents, guardians, superintendents of orphan asylums, etc. Such persons as insisted on variolation were to be held responsible for any danger resulting. On October 22, 1802, Rules were published for the foundation of an Institute for Vaccination, to be opened December 1, 1802. The objects were to give all, especially the poor, conveniences for vaccination and the certainty of genuine material. Two healthy children between three and twelve years of age were to be maintained in the Institute, in order to insure a supply of material; certain days were set for vaccination; the patients were obliged to return on the eighth day; a journal was to be kept. A regulation of October 31, 1803, stated that new discoveries in medicine did not immediately come under governmental care. Since the previous proclamation the question as to danger and protection had been answered by the results of 17,741 cases. Eight thousand cases showed protection of from two to three years. Henceforth, vaccination was to be a special object of governmental control, in order to extirpate and destroy smallpox. The observation and reporting of cases was to continue; efforts were to be made to diminish the still existing prejudice against the operation. Variolous inoculation, though still permitted, was to be limited as much as possible. In case of need, country

pastors, school-teachers, and midwives were allowed to vaccinate, but only under direction of the nearest district physician. The sources of lymph were regulated, and traffic in virus was prohibited.

In most countries there was no control in any way. At the best, vaccination was carried on by physicians, surgeons, and apothecaries, and doubtless varied as much in method and results as did other therapeutic measures of the vaccinators. At the same time vaccination was taken up by the classes that have always zealously fostered new medical discoveries. Preachers and idle women were among the most active. The Rev. Mr. Finch vaccinated 3,000 people before 1802 was far advanced. Jenner spoke, in February, 1805, of 20,000 vaccinated by his "fair disciples," and one of them, Lady Charlotte Wrottesley, counted 10,000 of her own cases before 1808. One of Jenner's most malignant critics, Moseley, said: "The County Lord, Squire and Parson, encumbered with time and benevolence, have here employment offered them, and an opportunity of doing, as they were told, a great deal of good for a very little money, and also of making themselves better acquainted with their tenants, peasantry and parishioners." Jenner's lay disciples, however, were instructed, and he tells us few mistakes were made by them. This could not be said of the Gamps, merchants, peddlers, stage-drivers and sextons who followed the new business. By these, any sore was considered good for vaccination purposes.

It must not be supposed that vaccination was cultivated on so large a scale without opposition. There was some, but as in many other cases it often was

either ridiculed or overshot its mark and hastened the measure it attempted to check. The assertion that vaccination could not be depended upon for life-long immunity was almost universally derided by the contemporary advocates of the operation. "Had not the farmers proved that it was good for fifty or sixty years"? was the most frequent answer. The Royal Jennerian Society refused to investigate the time element, stating that it was settled, as early as 1804. The assertion that vaccination often left chronic ulcers, and in that respect was more unpleasant than smallpox, made little impression on a generation used to the issue and seton as mild and customary aids to health. The objection of Hufeland, that vaccination might make the human body susceptible to animal diseases, was one of the most reasonable advanced, but the assertions so often made in the beginning, that inoculation would be followed by bovine changes of mind, face, and figure could not make much impression on people who ate the flesh and drank the milk of the same species without harm. Still, some cases were reported in which it was asserted that after vaccination the patients coughed like cows or bellowed like bulls, and morbid fancy went so far as to predict the appearance of a new Pasiphae. Among the sarcasms launched, the neatest was that "the medical profession had introduced a new disease when it was not able to cure all the old ones."

Jenner never took part in the discussion that was at times warm but often frivolous. He did, however, publish a pamphlet, soon after the second, in answer to the publications of Woodville and Pearson. This was entitled *A Continuation of Facts and Observa-*

tions relative to the Variolæ Vaccinæ or Cow Pox (London, 1800).

In this, Jenner noticed the spread of vaccination, the satisfaction with which it was used, and the failure of those who attempted to depreciate it. He paid special attention to Woodville's cases of suppuration following vaccination, explaining them as due to variolation. His explanation of the subsequent decline of such accidents in Woodville's practice was that the "cow-pox virus assimilated the variolous, the former being original, the latter a modification."

As usual in Jenner's articles a number of interesting but not wholly relevant observations were introduced, such as cases of scarlatina and vaccination together and a case of measles with vaccination. He also suggested the time for checking the vaccine lesions, *i. e.*, about the tenth or eleventh day, if all had gone on regularly. He advised the application of a single drop of "aqua lythargyri acetati" for two or three minutes and the dressing of the efflorescence with "aqualythargyri comp." He reiterated his belief in the production of scrofula by smallpox, the greater safety in that respect of cowpox, and concluded the pamphlet by the statement,—now made so strongly for the first time, and destined to be a source of much difficulty—that in the cowpox we have "an antidote that is capable of extirpating from the earth a disease which is every hour devouring its victims; a disease that has ever been considered as the severest scourge of the human race."

By the year 1800, a new edition of the *Inquiry*, which had already been translated into Latin, French,

and German, was called for. It was issued, and also sold in one volume with the second and third pamphlets, with continuous pagination. A colored engraving, showing the lesions of vaccination and smallpox on successive days, was issued at the same time, and sold with the pamphlets or separately. Many of these were early sent to the United States, where some inferior reproductions were made. One of the original plates is bound with the McGuire-Osler pamphlets. The colored illustrations met the very serious charge that in Jenner's publications he never gave a systematic description of the vaccine vesicle. Such a description was first given by Ballhorn and Stromeyer, in 1799.

About the same time Jenner published some *Instructions for Vaccine Inoculation.* In these he described with admirable clearness the details of the operation and the clinical features of the resulting lesion. The following points are especially interesting: The virus is to be taken from a pustule showing the true character, making regular progress, from the fifth to the eighth day, or a day or two later, provided the areola be not formed (This was the "Golden Rule of Vaccination"). "A single pustule is sufficient, but as we are not sure the puncture will take effect, it is prudent to inoculate in both arms, or in two places on the same arm, about an inch and a half apart, except in early infancy, when there is great susceptibility to local irritation." The virus is to be inserted by means either of a scratch, not exceeding the eighth of an inch, or of a very small oblique puncture. The commonest causes of faulty vaccinations, and some of the resulting lesions, are described. "A little practice in

vaccine inoculation, attentively conducted, impresses on the mind the perfect character of the vaccine pustule; therefore, when a deviation arises, common prudence points out the necessity of reinoculation, first with vaccine virus of the most active kind, and secondly, should this prove insufficient, with variolous virus." The general symptoms of vaccinia are described, but said not to occur in every case, and the later general symptoms are explained as due to the irritation of the pustule. Smallpox infection received before vaccination is said to be not always checked, although the pustule may advance without interruption. "The lancet used for inoculation should always be perfectly clean. After each puncture it is proper to dip it into water and wipe it dry. The practitioner should be particularly cautious in observing that its point be free from rust, either contracted by common means, or from the action of the vaccine virus." "The preservation of vaccine virus upon a lancet beyond the period of a few days should never be attempted; as it is so apt to produce rust which will decompose it."

If Jenner had died about this time his fame would have suffered no loss. He had given the world a discovery that had already produced extraordinary results. The future was necessarily beyond his power.

In May, 1801, he published a pamphlet on the *Origin of Vaccine Inoculation*. He explained that this was necessary on account of the confounding of casual cowpox with that excited by inoculation. He made a number of statements, some of which were new, some not. He spoke of the history of cowpox and of his early investigations. A curious statement is made with reference to some experiments which he

made after those described in his *Inquiry* in 1798, experiments which he says he went over "not only with great attention, but with painful solicitude." But the experiments mentioned are nowhere fully described. He said that the distrust and skepticism that naturally arose after his first announcement had nearly disappeared; 100,000 persons had been inoculated, and it "now became too manifest to admit of controversy that the annihilation of smallpox must be the final result of this practice."

In one of his letters Jenner remarked that it was *infra dig.* to go into controversy, but not so to lay cheering and persuasive reports before the public through the widely flowing channels of the newspapers. This pamphlet seems based on such views, but it seems strange he did not follow the equally dignified method of communicating exact observations without controversy. It is possible, however, the pamphlet was issued with a view to the parliamentary grant which was asked for a few months later. It is unfortunate that the historical and explanatory statements were not incorporated in the *Inquiry,* which would have been made more convincing than it was.

The grant of ten thousand pounds, given by Parliament to Jenner in 1802, is said to have assisted the spread of vaccination. There are many evidences that the action of parliament was used as if there had been an expert investigation of the facts, but this was not so at all. However, few remembered that the same body had given large sums before for alleged medical discoveries of the most worthless kind, as in

the case of Stevens, who was given £5,000 for his "stone solvent."

In 1804, Jenner published an article On the Varieties and Modifications of the Vaccine Pustule occasioned by an Herpetic State of the Skin, in the *London Medical and Physical Journal,* and reprinted it as a pamphlet in 1806. In this he said that his inquiries had been much more extensive since the first publication of the article, and that he hoped to lay the results before the public (this he never did). He described how herpetic conditions, so common in children, often prevented vaccine virus from producing its correct action, although, on the other hand, the operation often subdued chronic skin diseases of the same kind. (Jenner has also shown in his correspondence how strongly he believed in the adverse influence of skin diseases over vaccine. Not only was the specific action destroyed, but even the best virus, under such circumstances, might produce purulent pustules.) He admitted that he had been wrong in his former article in speaking of the vaccine lesion as a "pustule." He thought "pock" or "vesicle" better, but did not change the term for fear of creating confusion. He went on to describe imperfect vaccine lesions, many of which can readily be recognized from his descriptions. He was aware that many imperfect vesicles can be propagated, producing their like, a fact that even now is not properly appreciated by many vaccinators. But he not only clearly recognized imperfect lesions,—he had an efficient and rational treatment for them. This consisted in the reduction of the process as soon as discovered, and in reinoculation. In conclusion, he pointed out the need

of care on the part of vaccinators,—"who should be acquainted not only with the laws and agencies of the vaccine virus, but with those of the variolous also, as they often interfere with each other." This latter part should not apply now, but the following will always be useful: "A general knowledge of the subject is not sufficient to enable or to warrant a person to practise Vaccine Inoculation: he should possess a particular knowledge, and that which I should wish strongly to inculcate, as the great foundation of the whole, is an intimate acquaintance with the character of the true and genuine vaccine pustule. The spurious pustule would be readily detected, whatever form it might assume, and errors known no more."

In 1808, a pamphlet on *Facts, for the Most Part Unobserved or Not Duly Noted, Respecting Variolous Contagion* was published by Jenner. This is made up largely of extracts from the earlier articles. It showed the possibility of repeated infection with smallpox, a fact not so entirely unquestioned before Jenner's time as since; some of the most experienced practitioners had never seen smallpox twice in the same patients. There are also interesting observations on infections of the fœtus in immune mothers.

In 1818, a letter from Jenner to William Dyllwyn, Esq., on The Effects of Vaccination in Preserving from the Small-pox was published by the Philadelphia Vaccination Society. In this, Jenner discussed a number of problems relating to vaccination, including the herpetic state of the skin. The same subject was discussed in a Letter addressed to the Medical Profession generally, relative to Vaccination, in the *London Medical and Physical Journal*, Vol. 48, 1821.

In this he again referred to the action of herpetic conditions, among which he included "dandriffe," and he mentioned a case in which a small whitlow on the thumb altered the course of vaccine.

The last work, very interesting, but not bearing on vaccination, is a letter to Parry On the Influence of Artificial Eruptions in Certain Diseases incidental to the Human Body. London. 1822.

Jenner died soon after this on January, 26, 1823. One cannot but regret that he did not write more in the last twenty years of his life. It is difficult to ascertain what he really did in that time. Whenever he was accused, as he was more than once by friends and enemies, of indifference, or of having been spoiled by his grants from parliament—a second for £20,000 was given in 1807—his usual reply was that he had an enormous correspondence in all parts of the world regarding vaccination,—he was "vaccine clerk to the world." In the early days of vaccination he was busy inoculating, and it is said that as many as 300 applicants waited upon him daily. But it is impossible to understand why most of the correspondence could not have been put off through the agency of medical journals, and the manual labor of vaccinating be done by one of his disciples. However, a discussion of these problems would be idle now, and it would be more useful to ask what the profession did with the discovery he gave them and what we are doing now with it.

Before leaving this part of the subject permit me to show some lantern slides that I think will be of interest. These are photographs from the title pages of some of the McGuire-Osler pamphlets, part of the

dedication and text of the *Inquiry,* and the four plates from the latter. The first of these, the cowpox on the hand of Sarah Nelmes, has been pronounced by many contemporaries an admirable representation; the next shows a vesicle, the second remove from a sore heel or grease case; the next the vesicle in a late stage on the arm of William Pead; and the last that on the arm of Hannah Excell, the last three being from the second experiments described in the *Inquiry.* I show also Jenner's set of pictures published in 1801, from drawings by William Cuff, who had colored Jenner's earlier plates and afterwards made some for other books. He stated before the parliamentary hearing that he had seen hundreds of vaccine vesicles, and the fidelity of his work has always been admitted. With this, a photograph of Jenner's *Instructions* will be interesting. Finally, by the kindness of Dr. J. H. McCollom, of Boston, I show the plate of Bousquet, published in 1836 (J. B. Bousquet, *Sur le Cowpox (Petite vérole des Vaches) découvert à Passy, etc.,* Paris. 1836.) showing the appearances of vaccine vesicles from a recent case of cowpox, and from the virus of 1800. The degeneration of the older virus is evident, yet I think few will affirm that it is not better than most of the material now available.

Let me recall in a summary way what Jenner did with vaccination. He recognized, and made others recognize, the protection given by cowpox against smallpox. The truth of this belief I do not consider it necessary to discuss. Any one willing to take the pains to make an extensive study of the matter, will, I think, draw no other conclusion. Isolated experi-

ences can readily be met by equally striking counter claims.*

Jenner recognized the necessity of using virus only from typical and regularly progressing vesicles, in certain stages, free from complications.

He insisted on the greatest care in all steps of the operation, and on a cleanliness that even now, after twenty-five years of bacteriological teaching, is far from being general. Many of his contemporaries used saliva to moisten the virus.

He made a comparatively slight wound. Others after him often used blisters to make a raw surface, laid the virus on this, and turned or pressed the virus in the wound after an interval of a few days.

He recognized many cases of failure, and while his explanation of these was probably wrong, he not only was prepared for failure, complete or partial, but insisted on reinoculation or even variolation, in order to run no risk. How often, even now, we find physicians who think that when vaccination fails to "take," no matter how carelessly done, the subject is immune to smallpox.

He also insisted on careful observation of all cases, and the possession of a full and critical knowledge of vaccine lesions by those who inoculated.

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* Among the number of recent books and articles useful to any one who wishes to begin such an investigation the following may be recommended: the article by Dr. Samuel W. Abbott, on Progress of Hygiene, *Boston Medical and Surgical Journal*, May 1, 8, and 15, 1902; *Legislation with reference to Smallpox and Vaccination*, by the same, Massachusetts Medical Society, 1902; *Facts about Smallpox and Vaccination* and *The Lesson of a hundred years of Vaccination in Europe*, 1796-1896. Published by the British Medical Association; *A Concise History of Small-pox and Vaccination in Europe*, by Edward J. Edwardes, 1902; Kübler, *Geschichte der Pocken und der Impfung*, Berlin, 1901.

Jenner's only fault regarding his discovery was the tenacity with which he held to the idea of life-long immunity. His principal adherents held the same view with equal pertinacity. As many of Jenner's partisans deny that he was ever mistaken and in order to avoid an excess of dogmatism myself, I give some quotations. In a letter to Ingen-housz (Baron's *Life of Jenner,* Vol. 1, p. 294) he said: "At present I have not the most distant doubt that any person who has once felt the influence of perfect cowpox matter would ever be susceptible of that of the smallpox." His test of this perfection was variolation. In a letter to Dunning, quoted in the *London Medical and Physical Journal,* he wrote: "A person on whom the vaccine pustule has been excited by perfect matter, and which has completely gone through the progressive stages of inflammation, maturation and scabbing, is ever after secure from the smallpox." A favorite phrase with Jenner and his disciples regarding the question of permanence, was that doubt was refuted by "volumes of evidence and a cloud of witnesses." As a matter of fact, there were no such volumes, and the witnesses were incompetent because their period of observation was too short. Later, Jenner said that "vaccination duly and efficiently performed will protect the constitution from subsequent attacks of smallpox as much as that disease will." This is reasonable enough, but even much stronger claims might readily be excused in the originator of the method, while they would never release the profession from the duty of putting the claims to the practical test.

It would take too long to trace the history of small-

pox and vaccination in detail from the time of Jenner. As I have already shown, vaccination was widely used all over the civilized world within a short time after Jenner's first publication. For a time smallpox became notably less common, and even ceased in many places, perhaps in most places with relatively fixed population and careful vaccination. Gradually the disease began to reappear. Sometimes it was very mild and caused great confusion in diagnosis; it was often mistaken for chickenpox, but finally, under the name of varioloid, given by John Thomson in 1820, it was recognized as mild smallpox, with all the dangers of infection of the more severe forms. In 1825 smallpox was nearly as prevalent in London as in any of the three great epidemics of the eighteenth century, and in very many parts of Europe it was equally serious. The causes of the recrudescence were more difficult for physicians of that time to discover than they are for us, with the experience of a century to guide us. Large numbers of people had been vaccinated so long before that their one-time immunity was partly or wholly lost. There were also many who had never been vaccinated, because the diminution of smallpox made the need of some protection less imperative than otherwise, and there were, of course, relatively few who were protected by smallpox. Smallpox virus still existed in many places. Not only were no efficient attempts made at the destruction of the cause, but it was actually kept alive by the practice of variolation. Jenner's efforts to prohibit that failed, and it was not until 1835 that it was stopped by law in Prussia, in England not until 1840. And so, the conditions necessary for an epi-

demic being present—the contagium and a number of unprotected people—the epidemic began. Wherever the disease was prevalent, some vaccinated people were sure to take it, but in almost all places it was clear to observers that most of those who got smallpox either were not vaccinated at all, or had been long before, or showed evidences of imperfection in the results of the operation. On the contrary, recently vaccinated people were as well protected as in the beginning. In the second quarter of the last century such observations led to a very active discussion, and the belief in the advantages and need of revaccination developed. This, however, grew slowly. It was opposed in England and France, and though suggested as early as the '30's in the United States did not lead to active measures. We owe our knowledge of revaccination to Germany. It was advised by the government of Würtemberg in 1829, and made obligatory for all recruits in the army of that State in 1833. After a trial under Prince Wilhelm, afterwards Emperor Wilhelm I, it was ordered for the Prussian army in 1834. Other German States adopted the measure later, some of them not until the '60's, for their armies. The results in all the armies were unmistakeable, but the knowledge thus gained was not acted upon by the general public, or even by a large number of physicians.

So smallpox continued to exist everywhere, although the mortality was lower than in the preceding century. Three facts appear conspicuously in the often obscure statistics of the middle of the nineteenth century: The lower absolute mortality from smallpox, the notably smaller morbidity in the years

following the usual age of vaccination (smallpox was no longer "Kinderpocken"), and the particularly great prominence of these facts in countries having the most efficient vaccination. But there were many minor facts that weakened all of these, and the clearer recognition of the spread of syphilis by humanized vaccine, and of the nature of wound infection, led to much open or concealed objection to vaccination. The introduction of bovine virus did but little at first to overcome these objections.

The most striking object lesson on the value of vaccination was given by the Franco-German war of 1870-71. France had neglected systematic vaccination, though that country had been the seat of many valuable observations ever since the time of Jenner. By 1869, a large number of unprotected persons were living there, and in the following winter smallpox increased rapidly. By July, 1870, the monthly mortality had reached 983. In May, a congress of physicians met in Paris, to consider methods of meeting the epidemic, but before they could accomplish anything they were called upon to meet other enemies. When the army was mobilized in July, infected men were soon crowded in with others, in the usual conditions of a state of war. The troops already under arms were not so well and thoroughly vaccinated as they should have been, and the reserves could not be revaccinated for lack of time. Very soon smallpox had increased to such an extent that, as Thiers and his colleague reported, it was more frightful than the war itself.

The total loss of the French army from smallpox cannot be accurately stated. The figure 23,400

quoted by the War Office from a statement made at the Statistical Congress, in 1872, is probably too high. It was very large, however. This epidemic was only part of a greater one, affecting almost every country. In many places the increase had begun before the outbreak of hostilities in France, but during the war many examples of direct infection could be traced in the surrounding countries. This was especially true of those places in Germany where prisoners of war were quartered.

Among all the people affected by the epidemic one class was relatively spared. This was the German army. Exposed in a hostile country, undergoing the same fatigues and in many cases the same privations as the enemy, it showed an unmistakable immunity that the fortunes of war could not explain. During the whole war only 4,991 men, officers, surgeons, etc., had smallpox, and only 297 died. Not only was the mortality much smaller than that in the opposing army, but it was also smaller than in the civil population of Berlin during the same period, among men of the same age. The great point of difference was that the German soldiers under arms at the declaration of war had all been revaccinated within two years. Many reserves were also revaccinated on their mobilization, though many were not until after the lapse of several months.

The newly formed German Empire soon took up this lesson of the war, and in 1874, a law was passed providing for the vaccination of every child before the end of its second year, and every school-child in its twelfth year. The result of the operation was to be a matter of record, and failure to produce a satis-

factory vesicle required a repetition of the operation. The results of this justified the law. Both in the army and in the civil population the mortality from smallpox sank and remained permanently low, in marked contrast with countries in which revaccination was not required. In 1899 the deaths from smallpox in the whole empire numbered only 28. Most of these occurred near the boundaries of countries having a good deal of smallpox, and many were directly traceable to infection from those countries. The 28 deaths took place in 21 different places, giving striking evidence of the difficulty of the disease's spreading in Germany. As I remarked before, the death rate in the army has been lower since revaccination was made general. As the army was just as well vaccinated before, this shows the great value of widespread vaccination, and proves the truth of a statement made by the German commission in 1884; "Vaccination is beneficial not only to the individual, but generally."

While this has been done in Germany, and while several other continental nations have made great advances, two countries that boast the highest material prosperity and perfection and the most advanced interest in private or personal hygiene have not made any improvements, but in one case even, by the passage of the "Conscience Clause" in England, an actual retrogression. In England the epidemic followed the relaxation of the vaccination laws with customary promptness; in our own country, as I pointed out a year ago, the causes were complex. At present the epidemic in the United States seems to be declining, and although it may increase with the

advance of winter, it should be over in a year or two more. But abundant experience proves that unless some radical changes are made in our method of dealing with the problem another epidemic will follow within a few years. The active and enforced vaccination of the last four years will cause a feeling of indifference that, with the decline of the epidemic, will be followed by neglect and the growth of another group of more or less unprotected people. The present epidemic has been mild; so mild that it has not caused as much inquiry as is desirable, but there is no reason for thinking another epidemic may not be much more severe. Some writers of eminence have even asserted that the present mildness is due to a partial inherited immunity from vaccination of the parents. I do not believe there is any safe ground for this view and it may prove very misleading.

I have spoken of the inadequacy of sanitation and of cleanliness in relation to smallpox, and it may be well to return to that aspect of the question. Thousands of examples prove that cleanliness alone will not protect either an individual or a locality from smallpox. The virus is too elusive and too difficult to destroy, at least with our present ignorance of its exact nature, and has a too certain faculty for picking out unprotected persons. The example of Cleveland within the last year is one that should be remembered and its lesson taken to heart much more than seems to be the case. It was altogether natural that the apparent efficiency of sanitation in that city should have been loudly heralded. It is unfortunate that we have to introduce one disease in order to

keep out another, but the reappearance of smallpox proved again, as it so often has before, that we cannot yet reckon without vaccination except at the risk of a heavy penalty.

Nothing but a return to Jennerian principles, improved by the knowledge of the need of revaccination, can be depended upon to preserve us from such visitations. To neglect the lesson is just as wrong as it would be to give up any one of our sanitary advances.

There must be a general vaccination, and equally general revaccination. The more widespread both these are, the less likelihood is there of smallpox spreading. We need not seek far to ascertain when the operations should be done. The experience of Germany furnishes a practical example that must be excelled or break down before it can be seriously asserted to be insufficient. At the same time the scientific question as to the duration of immunity should be investigated whenever suitable cases present themselves.

The first objection to general vaccination is that in a free country it could never be carried out. To this I think it can be fairly answered that it has never been tried. Perhaps it could not be carried out at the request or advice of a profession or part of a profession, or of a body of politicians, but if the governing power, *i. e.*, the people, understood the facts, it is more than likely that they would prefer an orderly, systematic, carefully planned vaccination rather than the hurried, panic-suggesting method, just as in the days before Jenner they preferred other despotic restrictions rather than risk smallpox. From the point

of view of politics, general vaccination is an ideal democratic institution. The legal or constitutional aspects of the matter have not seemed to me necessary to discuss. Events in the last few years have shown that the desire for a thing by a powerful country has much to do with legal decisions and constitutional interpretation. Recognizing that vaccination is not done solely for the individual, but partly for the community, and that our neighbor's efficient vaccination helps to protect us, it would seem just as proper to pass laws requiring vaccination and revaccination as it is to compel property owners to make sewer connections, or to regulate the location of slaughter-houses or other possible nuisances.

An important, even essential, part of such an arrangement relates to the supply of safe and efficient vaccine virus. Regularity of vaccination would materially assist the production of such virus. As it is now, a sudden emergency may not only cause a temporary interruption in the supply of lymph, but, even worse, it may result in putting on the market, and in the hands of vaccinators, virus hastily prepared, imperfectly tested, and either dangerously inert or bearing the germs of fatal disease.

Even with a more regular demand for virus, it seems to me essential that the production of that be taken out of the ordinary lines of trade. If vaccination is a part of public hygiene, and not merely an operation for the security of the individual, it would seem that the State should either furnish, or at least test and control the material used. The laws of trade cannot easily regulate such a matter, for the rule, *caveat emptor*, cannot be applied at present to

vaccine as it can to alkaloids and salts. It is possible to conceive a philanthropic trust of vaccine makers, partitioning territory and competing only by the final results of scientific tests, but I fear the makers at present would be the first to laugh at such a suggestion.

From the earliest days of vaccination to the present time commercialism, to use the common euphemism, has seriously interfered with the development and results of the practice. The wholesale development of tetanus in 1901, which Dr. McFarland's analysis clearly traces to vaccine virus and not, as we should prefer to believe, to accidental infection, seems to have been due to the same spirit that, a hundred years ago, sold strips of a shirt sleeve encrusted with pus for genuine virus. It has been said that it is impossible in this country to take the manufacture of vaccine virus out of the hands of commercial bodies. This is just as irrational as to say we cannot ever get systematic vaccination. It is also said that vaccine made in State institutions would be still less reliable than it is now. This is equally unnecessary. No one that I know of recommends that janitors in public buildings or political pensioners of any kind be put in charge of such matters. The experience of several European countries and of a number of departments of our own general and local governments makes it certain that equal talent, industry, and fidelity could be obtained by such bodies as by commercial houses. Even if the cost of retaining men of ability by public bodies were greater than in private corporations, the difference would be more than made up by the saving in the cost of smallpox epi-

demics. I have known of single cases of smallpox that cost cities or communities more than the salary of many a professor of bacteriology.

The failure of commercial virus within the last few years has made one of the most efficient health officers in the country raise his voice in favor of a return to humanized virus. Strong as were the arguments of Dr. McCormack, however, I do not think that his suggestion could safely be followed without throwing the strongest restrictions around those permitted to vaccinate and without a training in vaccination such as few now have. Moreover, the proposal ignores the fact that better and safer virus than most of ours can be made.

Training and expertness on the part of operators was one of Jenner's particular aims. In this country most of the training seems to be derived from the publications of vaccine makers, and it is instructive to see that they recommend a method not only irrational but really dangerous, viz., by means of an extensive scraping or scarification, so deep that a scab forms before the virus begins to act. Such a wound must favor the development of accidental infections, It would not be used by a bacteriologist in an experimental inoculation; surgeons try to avoid it in operating; it is prohibited in Germany, and not used by the best vaccinators in England, yet so firmly has it been fixed in the minds of the vaccinators that pictures are published of lesions called "typical vaccinia" in which the chief feature is a large and wholly unnecesary scab.

The neglect of the early steps of vaccination finds its logical conclusion in more than ignoring the final

stages. If any observation of the results of the vaccination are made they are rarely recorded. Since no objective record is kept, little attention is paid to the matter. If the operation fails the patient is often told he is immune to smallpox; if on the other hand he has a phlegmon he is comforted by being reminded how severely he would have had smallpox had he not been vaccinated.

Perhaps many of the ideas I have advanced may seem visionary. I do not myself expect a very rapid change in the attitude of the profession and the public. But there are some other thoughts that are suggested by a study of the history of vaccination. We must carefully distinguish between the physician as a health officer, as a citizen, and as a therapist advising his patient. The first usually has his duties prescribed for him, and I shall not allude further to him. As a citizen the physician should take an active part in furthering all matters tending to the physical welfare of his fellow-citizens. He should therefore inform himself upon the actual condition and possibilities of vaccination, as a matter of supreme importance, and endeavor to influence opinion toward the most accurate and far-reaching laws and practices.

As a therapist, he should encourage careful and thorough vaccination, with the best available virus, the most accurate surgical technics, and the aim of securing a perfect and reliable result. By choosing the best season of the year and the most favorable state of the patient, he should avoid vaccinating at times when virus is likely to be hurriedly prepared, when infectious diseases are especially prevalent, and

when general alarm and unrest fill the air. He should point out to persons able to understand the risks of the operation, why it is we run such risks, just as he would do in advising any other surgical operation. He should avoid giving a false sense of security, or an assurance of freedom from harm, for as the wise Prussians said a century ago, he cannot guarantee those things.

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